

MONTANA CLINICAL COMMUNICATION AND SURVEILLANCE REPORT



Montana Department of Public Health and Human Services
Chronic Disease Prevention and Health Promotion Program
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ISSUE: OCTOBER - DECEMBER 2008

BACKGROUND

DIABETES IN PREGNANCY: SELECTED MATERNAL MORBITIES AND BIRTH OUTCOMES IN AMERICAN INDIAN AND WHITE WOMEN WITH AND WITHOUT DIABETES FOR THREE TIME PERIODS, 1989-1994, 1995-2000, AND 2001-2006.

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Diabetes In Pregnancy: Selected Maternal Morbities And Birth Outcomes In American Indian And White Women With And Without Diabetes For Three Time Periods, 1989-1994, 1995-2000, And 2001-2006.

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Save the Date!

- Heart Smart - Heart Healthy VIII
"Making the Connection"
- Montana Cardiovascular Health Summit
- Annual Diabetes Professional Conference

Diabetes is one of the most common medical conditions in pregnancy. Diabetes may exist before pregnancy or be diagnosed as gestational diabetes. Both pre-existing diabetes and gestational diabetes are associated with adverse birth outcomes and complications at delivery. In addition, mothers with gestational diabetes are at high risk for developing gestational diabetes in any subsequent pregnancy and for developing type 2 diabetes within several years after the pregnancy.^{1,2} Offspring of a diabetic pregnancy are at high risk for childhood obesity and type 2 diabetes developing at a young age. In addition, female offspring exposed to diabetes *in utero* are themselves at risk of having gestational diabetes when they become pregnant. Because of the importance of diabetes during pregnancy, birth certificates in Montana specifically indicate whether the birth was complicated by diabetes.

The report describes selected trends in maternal risk factors, obstetrical outcomes and neonatal morbidities in both white and American Indian mothers with and without diabetes coded on the birth certificate.

METHODS

Birth records from Montana vital statistics for the years 1989 to 2006 were utilized to ascertain live births among women in the state. Montana residents with a singleton birth were included whether or not the woman was delivered in state or out of state. We excluded births to women who delivered in state, but did not reside in state. In addition, we excluded a small number of births among state residents whose race was not categorized as American Indian or white (less than 1%).

From 1989 to 1996, Montana birth certificates included a check box to indicate the presence of diabetes. In 1997, the birth certificate was modified to include two check boxes: one for “gestational diabetes” and the other for “pre-existing diabetes.” Data for three time periods (1989-1994, 1995-2000 and 2001-2006) were compared to assess trends in selected birth outcomes and maternal risk factors in American Indian and white women with and without any form of diabetes listed on the birth certificate. Abnormal condition of the newborn was defined as presence of any of the following: assisted ventilation, anemia, fetal alcohol syndrome, hyaline membrane disease, meconium aspiration syndrome, seizure or serious neurological dysfunction, significant birth injury (skeletal fracture, nerve injury, hemorrhage requiring intervention) or other specified abnormal conditions. Complicated labor was defined as the presence of any of the following: fever > 100 degrees Fahrenheit, moderate to heavy meconium, premature rupture of the membrane,

abruptio placentae, placenta previa, excessive bleeding, seizures in the mother, precipitous labor, prolonged labor, dysfunctional labor, malpresentation, cephalopelvic disproportion, cord prolapse, anesthetic complications, fetal distress, or other specified complication.

Data analyses were conducted using SASv9 (Cary, North Carolina). Birth records were grouped into three 6-year time periods to obtain a sufficient sample size to assess trends among American Indian and white women with and without diabetes during pregnancy. Odds ratio were calculated to assess the association of race by diabetes status on maternal risk factors (hypertension during pregnancy, eclampsia and tobacco use during pregnancy), method of delivery (primary or repeat cesarean section, traumatic delivery, induced labor and complicated labor) and birth outcome (pre-term birth, birth weight and abnormal condition of the newborn). Where appropriate, logistic regression analysis was used to adjust for age of the mother and gestational age. T-tests were used to compare mother’s age and parity by diabetes status within race and by race within diabetes status. Mean birth weight of infants by race and diabetes status were calculated by general linear regression analysis, adjusting for gestational age.

RESULTS

From 1989 to 2006, there were 193,856 live singleton births recorded among Montana women. In the first time period (1989-1994), 2.1 percent (n=1,407) of 66,154 births documented any form of diabetes on the birth certificate. In

the second time period (1995-2000), the number of singleton births decreased to 62,496 but the percent of births listing any form of diabetes on the birth certificate increased to 2.5 percent (n=1,564). In the third time period (2001-2006), singleton births increased (n=65,206), as did the percent affected by diabetes (2.8%, n=1,792).

Maternal demographics and risk factors

For the time period 2001-2006, mean age of women with diabetes during pregnancy was higher in both American Indians (28.5 years) and whites (29.9 years) compared to mothers without diabetes during pregnancy (American Indians, 23.8 years and whites, 27.1 years). Both American Indian and white mothers with diabetes during pregnancy also had higher mean parity than mothers without diabetes during pregnancy. Mother's level of education did not

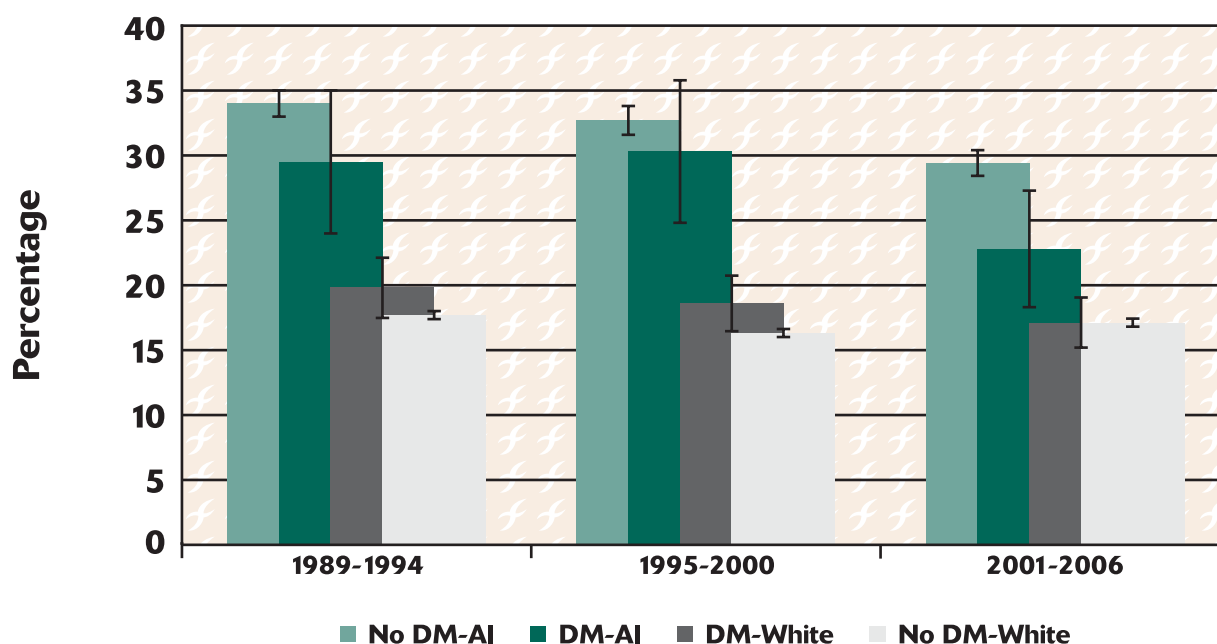
differ within race between women with and without diabetes during pregnancy.

For all time periods, hypertension during pregnancy was more prevalent among mothers with diabetes during pregnancy compared to mothers without diabetes during pregnancy, and there was no increase or decrease in the prevalence of hypertension during pregnancy over the time periods (data not shown). From 2001-2006, regardless of race, women with diabetes were three times more likely to also have hypertension during pregnancy than women without diabetes during pregnancy. Adjusting for age did not weaken this association (OR=3.09, 95% CI=2.69-3.55). Eclampsia was a rare event; only about one percent of live, singleton births in all time periods.

Table 1. Maternal demographics and risk factors by race and diabetes during pregnancy status, Montana 2001-2006.

	American Indian (AI)			White			No DM	DM
	No DM	DM	DM vs.	No DM	DM	DM vs.	AI vs.	AI vs.
	(N=8057)	(N=338)	No DM	(N=55357)	(N=1454)	No DM	White	White
	Mean (SD)		p-value	Mean(SD)		p-value	p-value	p-value
Age (years)	23.8 (5.7)	28.5 (5.8)	<.0001	27.1 (5.9)	29.9 (6.0)	<.0001	<.0001	.0005
Parity	2.4 (1.5)	3.0 (1.6)	<.0001	2.0 (1.2)	2.3 (1.3)	<.0001	<.0001	<.0001
	Percent		Odds Ratio [95%CI]	Percent		Odds Ratio [95%CI]	Odds Ratio [95%CI]	Odds Ratio [95%CI]
HTN during pregnancy	4.0	15.7	4.58 [3.35-6.28]	5.1	13.8	2.98 [2.55-3.48]	0.78 [0.67-0.85]	1.17 [0.84-1.62]
Tobacco used during pregnancy	29.4	22.8	.071 [0.55-0.92]	17.1	17.1	1.0 [0.87-1.14]	2.02 [1.91-2.12]	1.44 [1.08-1.92]

Figure 1. Tobacco use in pregnancy, by diabetes status and race, Montana 1989-2006.



In the 2001-2006 time period, tobacco use during pregnancy decreased significantly in American Indian women with and without diabetes during pregnancy and in white women with diabetes during pregnancy compared to earlier time periods (Figure 1). Historically, white women with diabetes during pregnancy were about 15 percent more likely to use tobacco during pregnancy compared to white women without diabetes during pregnancy. However in the most recent time period, prevalence of tobacco use during pregnancy among white women with diabetes during pregnancy was equal to white women without diabetes during pregnancy. Tobacco use during pregnancy decreased the most among American Indian women with diabetes during pregnancy, from 29 to 23 percent. However, these women were

still 44 percent more likely to use tobacco during pregnancy compared to white women with diabetes during pregnancy.

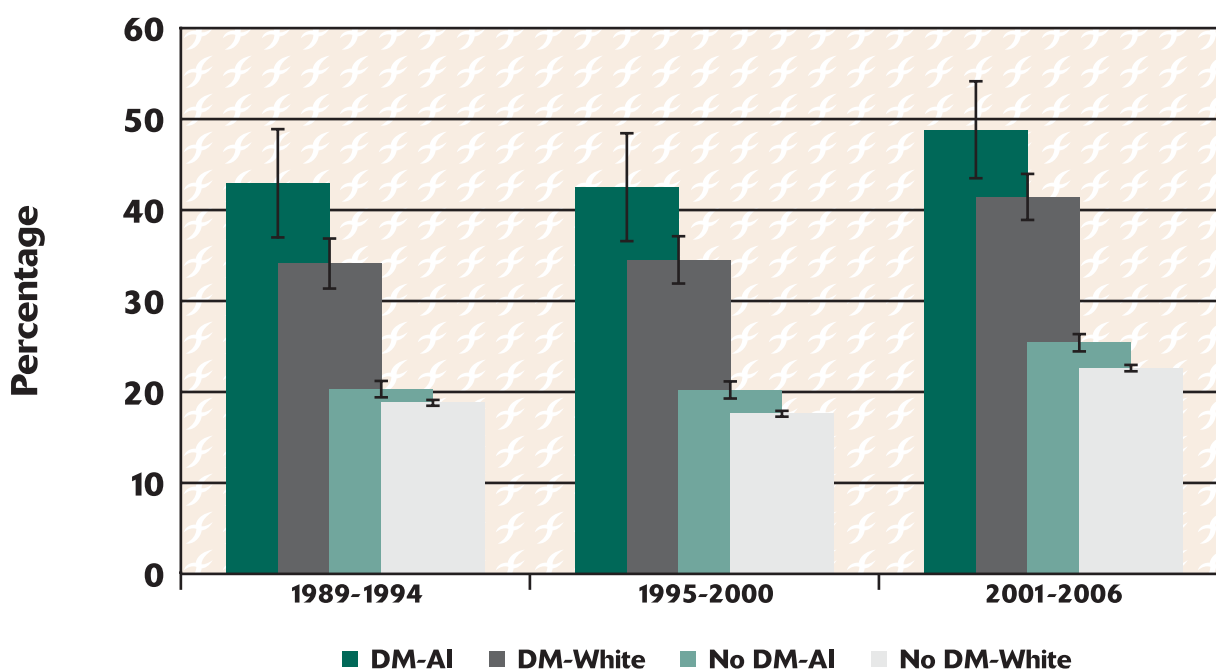
Obstetrical outcomes

The incidence of cesarean section increased about six percentage points, regardless of diabetes status and race, from 2001-2006 compared to earlier time periods (Figure 2). Regardless of diabetes status, American Indian women were about 20 percent more likely to have a cesarean section compared to white women (OR=1.19, 95% CI=1.13-1.25). Regardless of race, women with diabetes during pregnancy were 2.5 times more likely to have a cesarean section than women without diabetes during pregnancy (OR=2.51, 95% CI=2.28-2.76).

Table 2. Obstetrical outcomes by race and diabetes during pregnancy status, Montana 2001-2006.

	American Indian (AI)			White			No DM	DM
	No DM (N=8057)	DM (N=338)	DM vs. No DM	No DM (N=55357)	DM (N=1454)	DM vs. No DM	AI vs. White	AI vs. White
	Percent		Odds Ratio [95%CI]	Percent		Odds Ratio [95%CI]	Odds Ratio [95%CI]	Odds Ratio [95%CI]
Cesarean section	25.4	48.8	2.80 [2.25-3.48]	22.6	41.4	2.42 [2.17-2.69]	1.17 [1.11-1.23]	1.35 [1.06-1.71]
Introduction of labor	19.4	28.1	1.62 [1.27-2.07]	28.7	35.4	1.36 [1.22-1.52]	0.60 [0.56-0.63]	0.71 [0.55-0.92]
Complicated labor	33.9	38.5	1.22 [0.97-1.53]	33.1	40.3	1.36 [1.22-1.51]	1.03 [0.98-1.09]	0.93 [0.73-1.18]

Figure 2. Incidence of cesarean section delivery, by diabetes status and race, Montana 1989-2006.



Traumatic delivery (requiring forceps or vacuum) was the method of delivery in about five percent of all live, singleton births from 2001-2006, did not differ by race or diabetes status and was consistent across time periods. (Data not shown)

In the 2001-2006 time period, induction of labor was about 62 percent more likely in American Indian women and 36 percent more likely in white women with diabetes during pregnancy, compared to women without diabetes during pregnancy of the same race (Table 2). Among women with diabetes during pregnancy, the prevalence of induced labor has remained fairly constant over the time periods (Figure 3). In the most recent time period, among women with diabetes, induction of labor was about 30 percent more likely in white women compared to American Indian women (Table 2).

From 1989 to 2000, American Indian women had a higher prevalence of complicated labor compared to white women (Figure 4). The prevalence of complicated labor in 2001-2006 decreased in American Indians enough that this disparity was completely eliminated. Among white women, women with diabetes during pregnancy were still 36 percent more likely to have complicated labor compared to women without diabetes during pregnancy; but among American Indian women, women with diabetes during pregnancy were not significantly more likely to have complicated labor than women without diabetes during pregnancy.

Birth outcomes

The prevalence of high birth weight infants ($\geq 4,250$ grams) decreased significantly in 2001-2006, compared to the previous time period, in white women with and without diabetes during pregnancy and American Indian women without diabetes during pregnancy, but not in American Indian women with diabetes during pregnancy (Figure 5). While mean birth weight of infants born to white women with diabetes during pregnancy decreased 186 grams between the 1995-2000 and 2001-2006 time periods, these women were twice as likely to give birth to a macrosomic infant as white women without diabetes during pregnancy. American Indian women with diabetes during pregnancy were four times more likely to deliver a macrosomic infant as women without diabetes of the same race (Table 3). After adjusting for gestational age, American Indian women with diabetes during pregnancy were six times more likely to deliver a macrosomic infant than American Indian women without diabetes during pregnancy (OR=5.81, 95% CI=4.33-7.80).

Pre-term birth (birth at < 37 weeks gestation) was more prevalent in women with diabetes during pregnancy, regardless of race, compared to women without diabetes during pregnancy, in all time periods (data not shown). Among women without diabetes during pregnancy, pre-term birth was one-third more prevalent in American Indian women compared to white women (Table 3). Among women with diabetes during pregnancy, prevalence of pre-term

Figure 3. Percent of live, singleton births where labor was induced, by diabetes status and race, Montana 1989-2006.

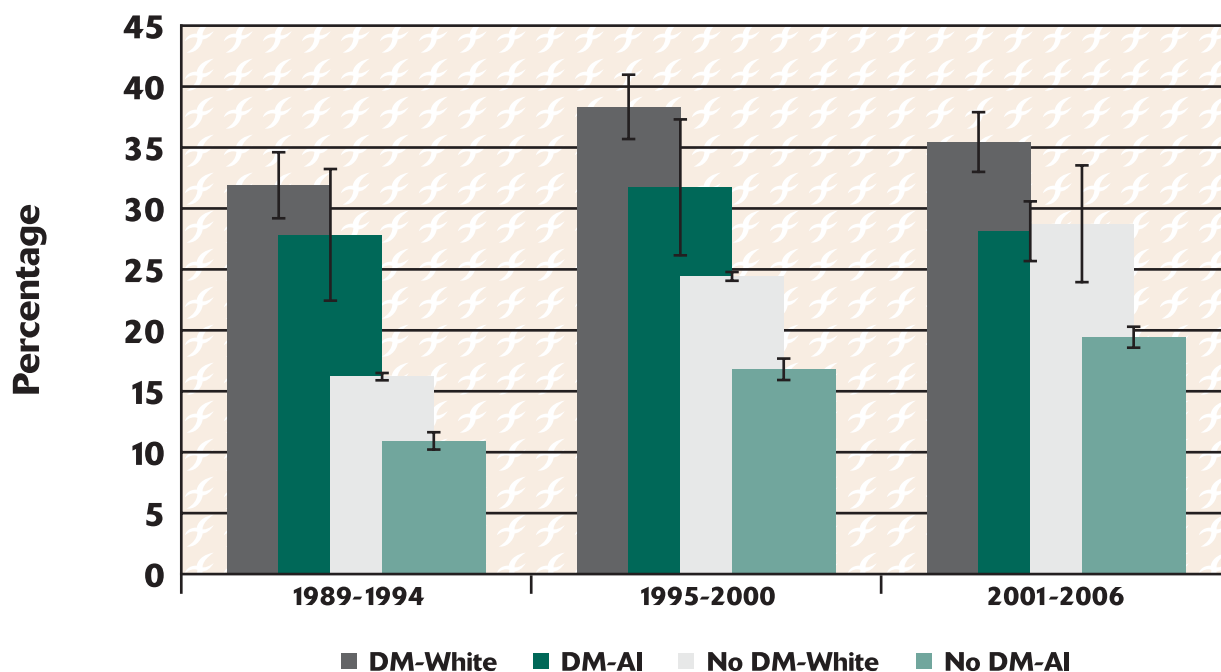


Figure 4. Percent of live, singleton births reporting complicated labor, by diabetes status and race, Montana 1989-2006.

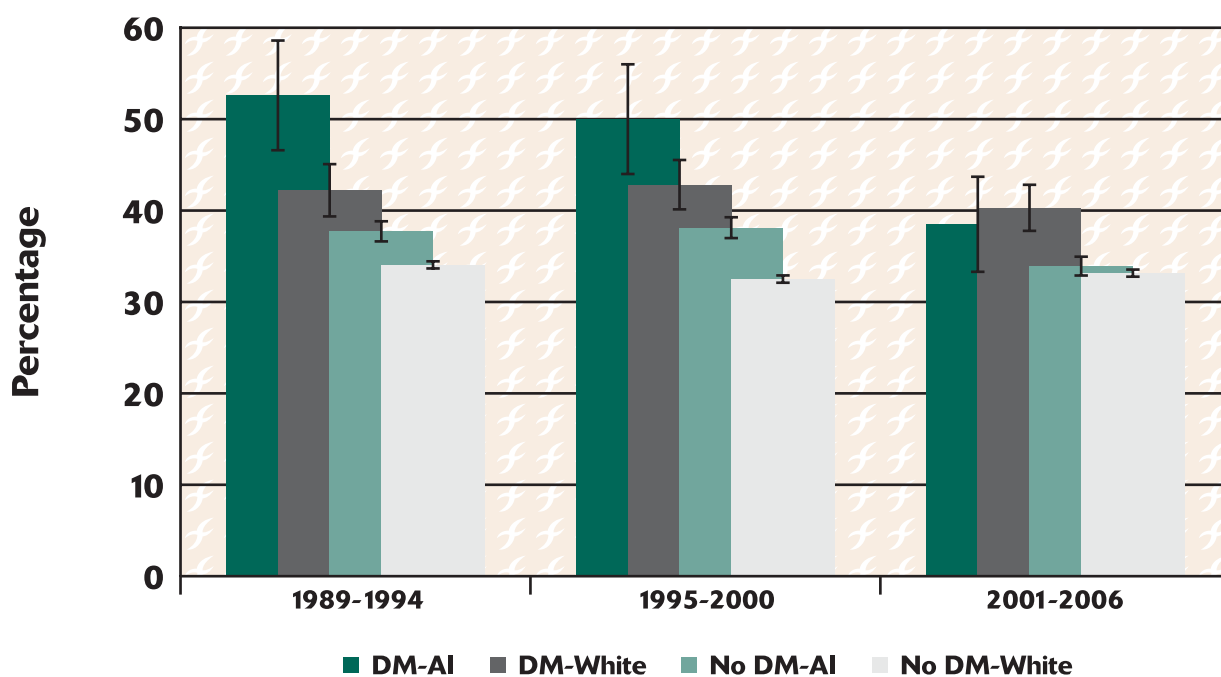
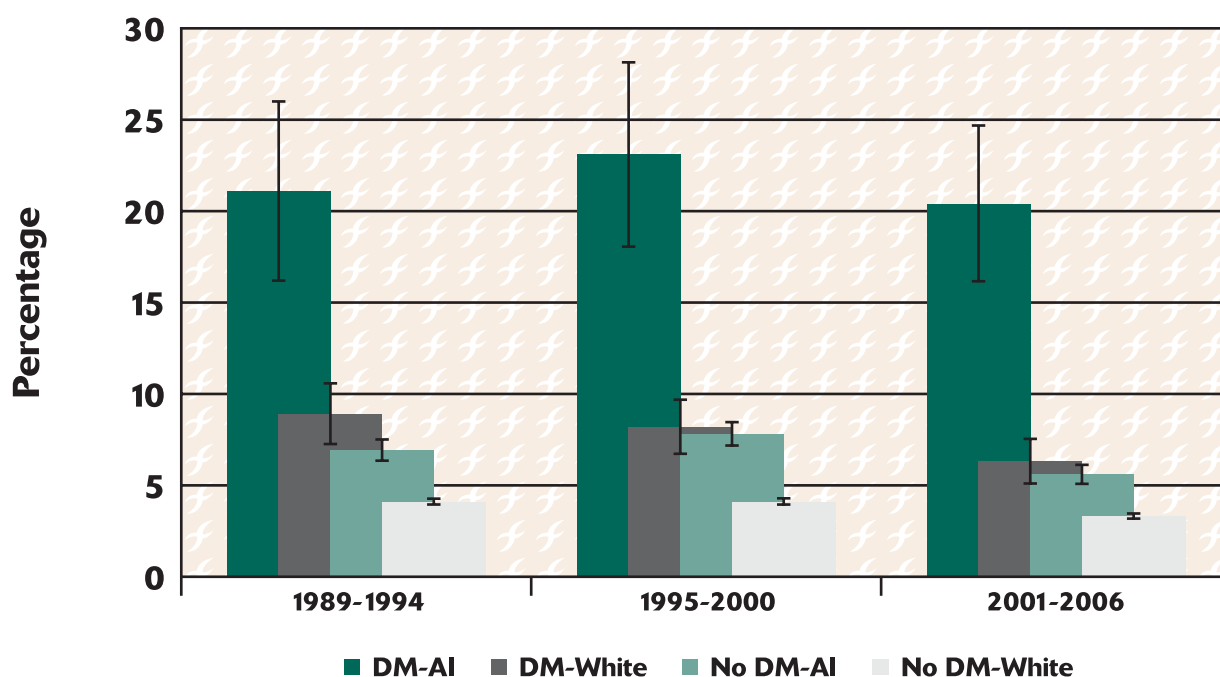


Table 3. Birth outcomes by race and diabetes during pregnancy status, Montana 2001-2006.

	American Indian (AI)			White			No DM AI vs. White	DM AI vs. White
	No DM (N=8057)	DM (N=338)	DM vs. No DM	No DM (N=55357)	DM (N=1454)	DM vs. No DM		
	Mean (SD)		p-value	Mean (SD)		p-value	p-value	p-value
Gestational age-adjusted birth weight	3396 (464)	3719 (464)	<.001	3369 (515)	3335 (515)	0.01	<.0001	<.0001
	Percent		Odds Ratio [95%CI]	Percent		Odds Ratio [95%CI]	Odds Ratio [95%CI]	Odds Ratio [95%CI]
Pre-term <37 weeks gestation	9.5	13.9	1.53 [1.12-2.10]	7.2	14.4	2.15 [1.85-2.50]	1.35 [1.25-1.47]	0.96 [0.68-1.35]
Birth weight ≤ 2500 g	5.8	4.1	0.71 [0.41-1.22]	5.1	6.1	1.19 [0.96-1.48]	1.12 [1.02-1.25]	0.67 [0.38-1.19]
Birth weight ≥ 4250 g	5.6	20.4	4.35 [3.29-5.77]	3.3	6.3	1.99 [1.60-2.47]	1.74 [1.56-1.93]	3.80 [2.71-5.33]
Abnormal condition of the newborn	7.3	16.6	2.52 [1.87-3.39]	4.9	9.4	2.02 [1.69-2.42]	1.55 [1.41-1.70]	1.92 [1.37-2.70]

Figure 5. Percent of live, singleton births where birth weight was 4250 grams or more, by diabetes status and race, Montana 1989-2006.

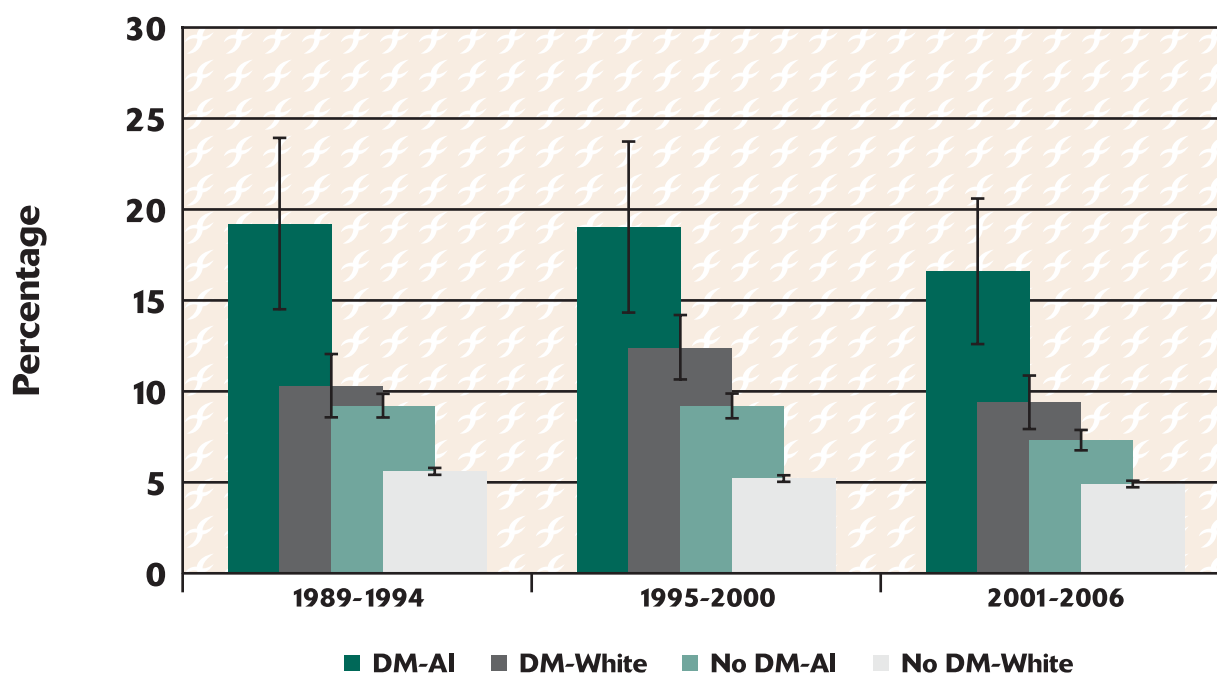


birth was about 14 percent, regardless of race. American Indian women with diabetes during pregnancy were 50 percent more likely and white women were twice as likely to have a pre-term birth compared to women of the same race without diabetes.

The prevalence of low birth weight infants was relatively low (4-6%), regardless of race or diabetes status, in all time periods (data not shown). Among women without diabetes in the 2001-2006 time period, American Indian women were slightly more likely to give birth to a low birth weight infant compared to white women (Table 3). This association was absent among women with diabetes in the 2001-2006 time period.

Compared to the 1995-2000 time period, the prevalence of an abnormal condition of the newborn decreased significantly in the 2001-2006 time period among white women and among American Indian women without diabetes during pregnancy, but did not decrease significantly among American Indian women with diabetes during pregnancy (Figure 6). Compared to women of the same race, women with diabetes during pregnancy were more than twice as likely to give birth to a newborn with an abnormal condition as were women without diabetes during pregnancy. Among women with diabetes during pregnancy, American Indian women were twice as likely as were white women to have an infant with an abnormal condition at birth (Table 3).

Figure 6. Percent of live, singleton births resulting in abnormal condition of the newborn, by diabetes status and race, Montana 1989-2006.



DISCUSSION

The percentage of births with diabetes recorded on the birth certificates has increased in Montana. Women with diabetes during pregnancy were older than those without mention of diabetes on the birth certificate. American Indian women were more likely to have diabetes in pregnancy than white women. Women with diabetes in pregnancy had a higher risk for hypertension during pregnancy, cesarean section, induced labor, complicated labor and pre-term delivery compared to women without diabetes during pregnancy. And infants born to women with diabetes during pregnancy were at higher risk for macrosomia and being born with an abnormal condition. But the percentage of women with complicated labor decreased in recent years - effectively eliminating the disparity in American Indians present in previous time periods.

Tobacco use during pregnancy also decreased in the 2001-2006 time period for all Montana women. However, white women in Montana were 30 percent more likely to use tobacco during pregnancy than US white women and Montana Indian women were 60 percent more likely to use tobacco during pregnancy compared to US Indian women.³ Obstetrical outcomes in Montana followed trends similar to those in the US with an increase in cesarean sections in the most recent time period, compared to earlier time periods, among all women in Montana. Gestational age-adjusted birth weight decreased in the most recent time period in all groups, most notably in white women with diabetes during pregnancy.

Despite the limitation that diabetes in pregnancy may not be recorded completely on birth records in Montana, these data suggest that careful attention to prenatal care and delivery for those with diabetes has resulted in fewer abnormal conditions in the newborn in recent years than was the case during the 1990s. Montana birth certificates now contain fields to record the mother's pre-pregnancy weight. Future surveillance reports will be able to examine the association of maternal pre-pregnancy weight to delivery outcomes.

Challenges remain. The proportion of macrosomic infants decreased among infants born to white women with diabetes during pregnancy, but infants born to American Indian women with diabetes during pregnancy remained at high risk for macrosomia. Diabetes in pregnancy is clearly a family issue with implications for the long-term health of the mother and offspring exposed to diabetes *in utero*. Thus, Montana clinicians should be alert to any history of gestational diabetes in women or exposure to diabetes *in utero* among youth and encourage the families involved to adopt lifestyle changes to prevent obesity and diabetes in both the mother and child.

REFERENCES

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² Dabelea D, Hanson RL, Lindsay RS, et al. Intrauterine exposure to diabetes conveys risks for type 2 diabetes and obesity: a study of discordant kinships. *Diabetes* 2000; 49:2208-2211.

³ Martin JA, Hamilton BE, Sutton PD, et al. Births: Final Data for 2005. *National Vital Statistics Reports*, Vol. 56, No. 6. Hyattsville, Maryland: National Center for Health Statistics, December 5, 2007.

SAVE THE DATE

HEART SMART - HEART HEALTHY VIII "MAKING THE CONNECTION"

FEBRUARY 5 & 6, 2009

Holiday Inn - Cody, Wyoming

The Cody Clinic's annual cardiovascular, diabetes and cancer education update series will be held on Thursday and Friday, February 5th & 6th, 2009. For more information, contact Dian True, RN, CDE at (307) 527-1947 or e-mail dtrue@billingsclinic.org

MONTANA CARDIOVASCULAR HEALTH SUMMIT

APRIL 3, 2009

**Holiday Inn Downtown at the Park,
Missoula, Montana**

The Cardiovascular Health Program's annual professional conference will be held on Friday, April 3rd, 2009. This year's keynote topic is long-term behavioral management of weight and type 2 diabetes. For more information, contact Crystelle Fogle at (406) 947-2344 or e-mail cfogle@mt.gov

ANNUAL DIABETES PROFESSIONAL CONFERENCE

OCTOBER 8 & 9, 2009

Crown Plaza Hotel - Billings, Montana

WHAT ARE THE MONTANA DIABETES PREVENTION AND CARDIOVASCULAR HEALTH PROGRAMS AND HOW CAN WE BE CONTACTED?

The Montana Diabetes Control and Cardiovascular Health Programs are funded through cooperative agreements with the Centers for Disease Control and Prevention, Division of Diabetes Translation (U32/CCU822743-05), the Division for Heart Disease and Stroke Prevention (1U50 DP000736-01) and through the Montana Department of Public Health and Human Services.

The mission of the Diabetes Control and Cardiovascular Health Programs is to reduce the burden of diabetes and cardiovascular disease among Montanans. Our web pages can be accessed at <http://www.diabetes.mt.gov> and <http://montanacardiovascular.state.mt.us>.

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